MATH 34B INTEGRATION

Indefinite integral:

$$\int f(x)dx = F(x) + C$$

Think backwards:

1. $\int \sec^2 x dx =$
2. $\int \frac{1}{x} dx =$
3. $\int 3dx =$

Power rule backwards:

1. $\int 2x dx =$
2. $\int x^3 dx =$
3. $\int \sqrt{x} dx =$

What was the general rule?

$$\int x^n dx =$$

Some basic rules:

$$\int kf(x)dx =$$

$$\int f(x) + g(x)dx =$$

More power rule backwards:

1. $\int 5x^2 - 9x^5 dx =$
2. $\int (\sqrt{x})^3 + \frac{3}{x^4} dx =$

Chain rule backwards:

1. $\int 2xe^{x^2} dx =$
2. $\int 3\cos(3x)dx =$
3. $\int \cos^2(x)dx =$

Method of substitution:

1. $\int \frac{2x+2}{\sqrt{x^2+2x+3}} dx$

2. $\int \frac{1}{x}\sec^2(\ln x)dx$

3. $\int x\sqrt{x+1}dx$

Applications:

1.The slope $f'(x)$ at each point (x, y) on a curve $y = f(x)$ is given by the formula

$$f'(x) = \sin x + x.$$

It is also given that $(0, 1)$ lies on the curve. Find $f(x)$.

2. A tomato is dropped from the top of a 34-meter tall building. Recall that acceleration due to gravity is -9.8m/sec^2.

a) Write down a function $v(t)$ that represents the velocity of the tomato t seconds after it is being dropped? (The units for $v(t)$ should be m/sec.)

b) Write down a function $h(t)$ that represents the height of the tomato t seconds after it is being dropped? (The units for $h(t)$ should be m.)

c) When will the tomato hit the ground?

d) What is its velocity when it hits the groud?

Additional practice:

1. $\int \sqrt{\pi}dx =$ (hint: $\sqrt{\pi}$ is just a number.)
2. $\int \frac{3}{x^8} + \frac{e}{\sqrt[8]{x^3}}dx =$
3. $\int \frac{3x^2-4x+8}{x^5}dx =$ (hint: split up the fraction first.)
4. $\int (3x+1)(x+2)^2dx =$ (hint: distribute/foil first.)
5. $\int \ln(2e^{\sin(x)})dx =$ (hint: use log rules to simplify this first; there are two rules involved.)

(Use u-substitution for the rest of the problems.)

6. $\int 2y^2e^{\pi-y^3}dy =$
7. $\int \frac{t^2+2t}{\sqrt[7]{t^3+3t^2+10}}dt =$
8. $\int \frac{x}{3x^2+8}dx =$
9. $\int \frac{\cos x}{\sin^2 x}dx =$ (hint: this is similar to the previous problem.)
10. $\int \frac{4}{x\ln x}dx =$

*11. $\int (\sin^2 x + 1)(\cos x + 2)dx =$ (hint: distribute; double angle formula; u-sub)